

# What is Climate Change?

Alaska FFA Association &  
USDA Northwest Climate Hub



*Permafrost thaw collapse claimed this cabin at Elson Lagoon, Alaska.*

*Photo credit: USGS*

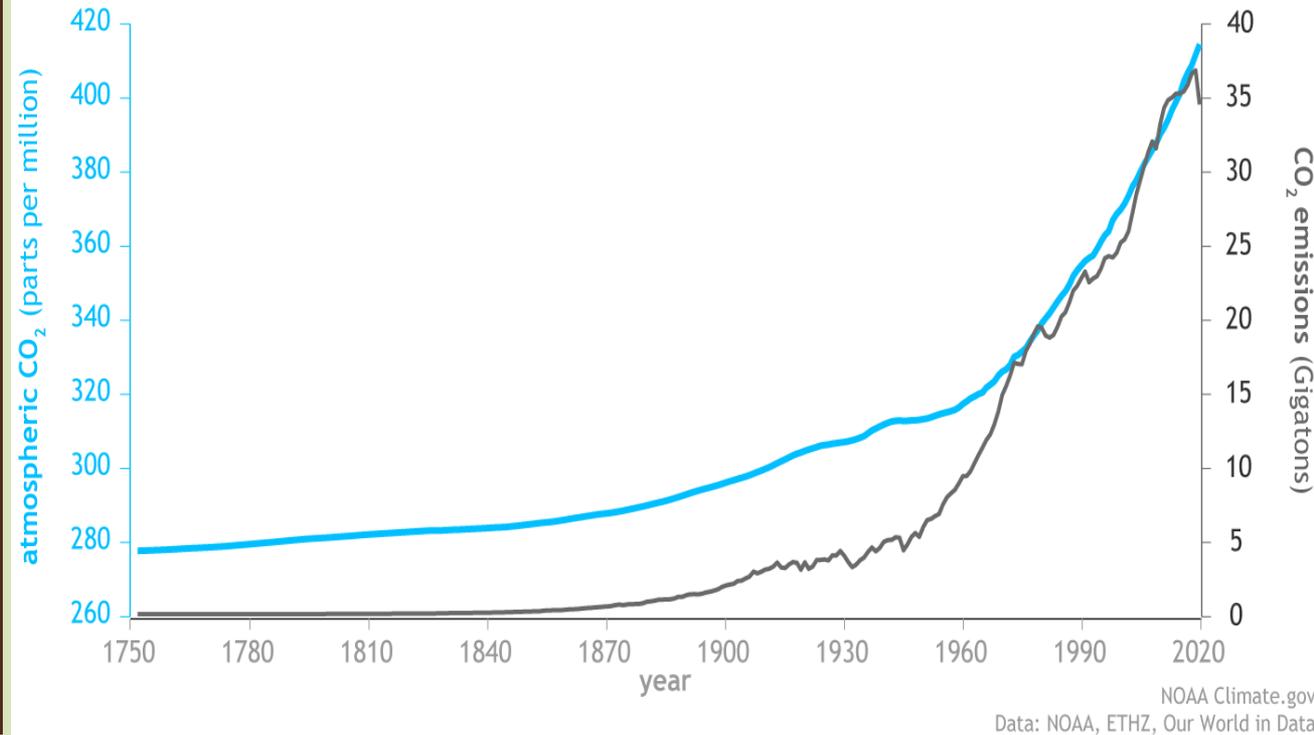


*Alaska's Muir glacier in August 1941 and August 2004. Credit: USGS*

Climate change is a long-term change in the average conditions, like temperature and precipitation, over a more than thirty-year period.

# What causes climate change?

Carbon dioxide emissions and atmospheric concentration (1750-2020)



- Natural and human-caused
- Greenhouse gases like carbon dioxide, methane, and nitrous oxide
- Burning fossil fuels

# Greenhouse Gas Effect

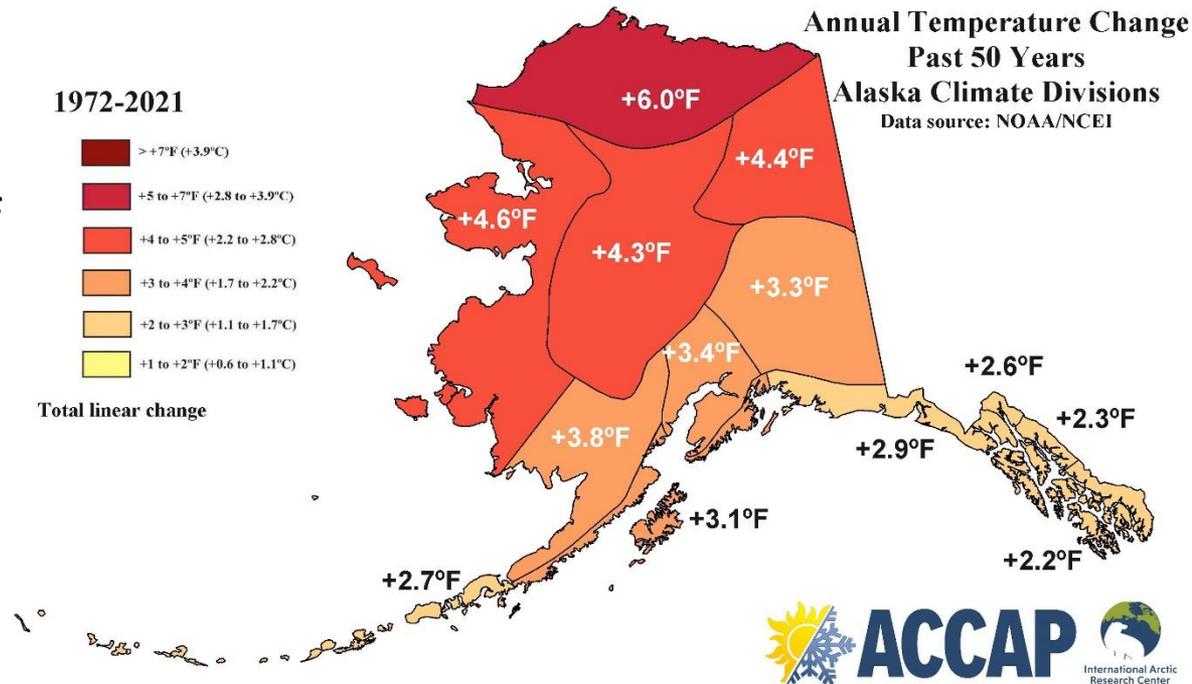
- [Watch NASA's "What is the Greenhouse Effect" Video](#)
- Earth's atmosphere is like a greenhouse
- Greenhouse gasses make Earth warmer
- Burning fuel to power factories, cars, and buses releases greenhouse gases



# How much has Alaska's climate changed?

## A LOT!

- Warming twice as fast as rest of U.S.
- Average annual temperature increase of 3 °F
- 6 °F increase in average winter temperature
- Fastest loss of glacier ice on Earth
- Sea ice loss has compounding effects on warming



# The effects of climate change in Alaska:

Rising temperatures throughout Alaska

Warming oceans and changes in sea levels

Shrinking glaciers; thawing permafrost

Sea ice melting faster, or not developing as early in the year

Changes in growing season

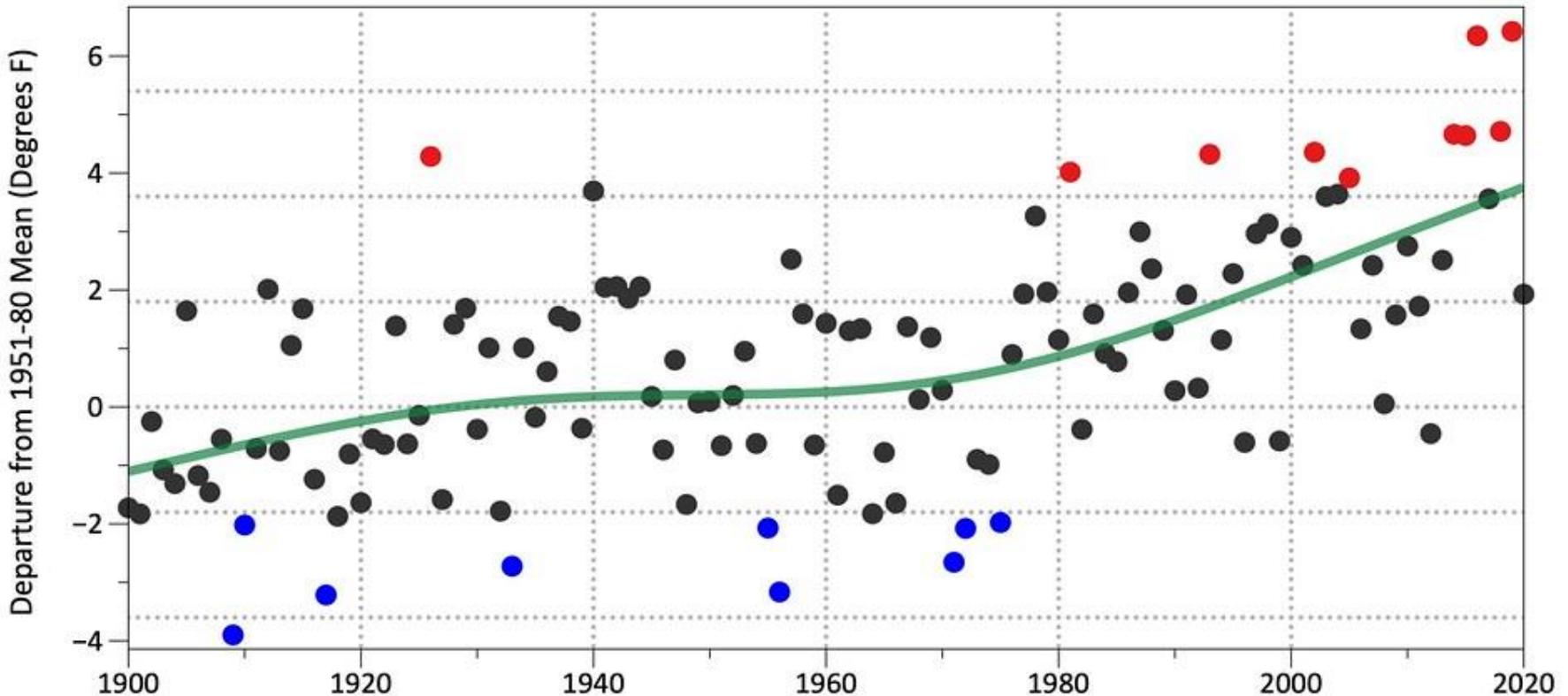
Extreme precipitation events, resulting in coastal and river flooding

Decreased snow cover, rain on snow

Longer and more intense fire seasons more frequent

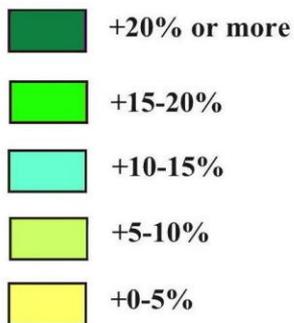
# Rising Temperatures

## Alaska Annual Average Temperature 1900 to 2020



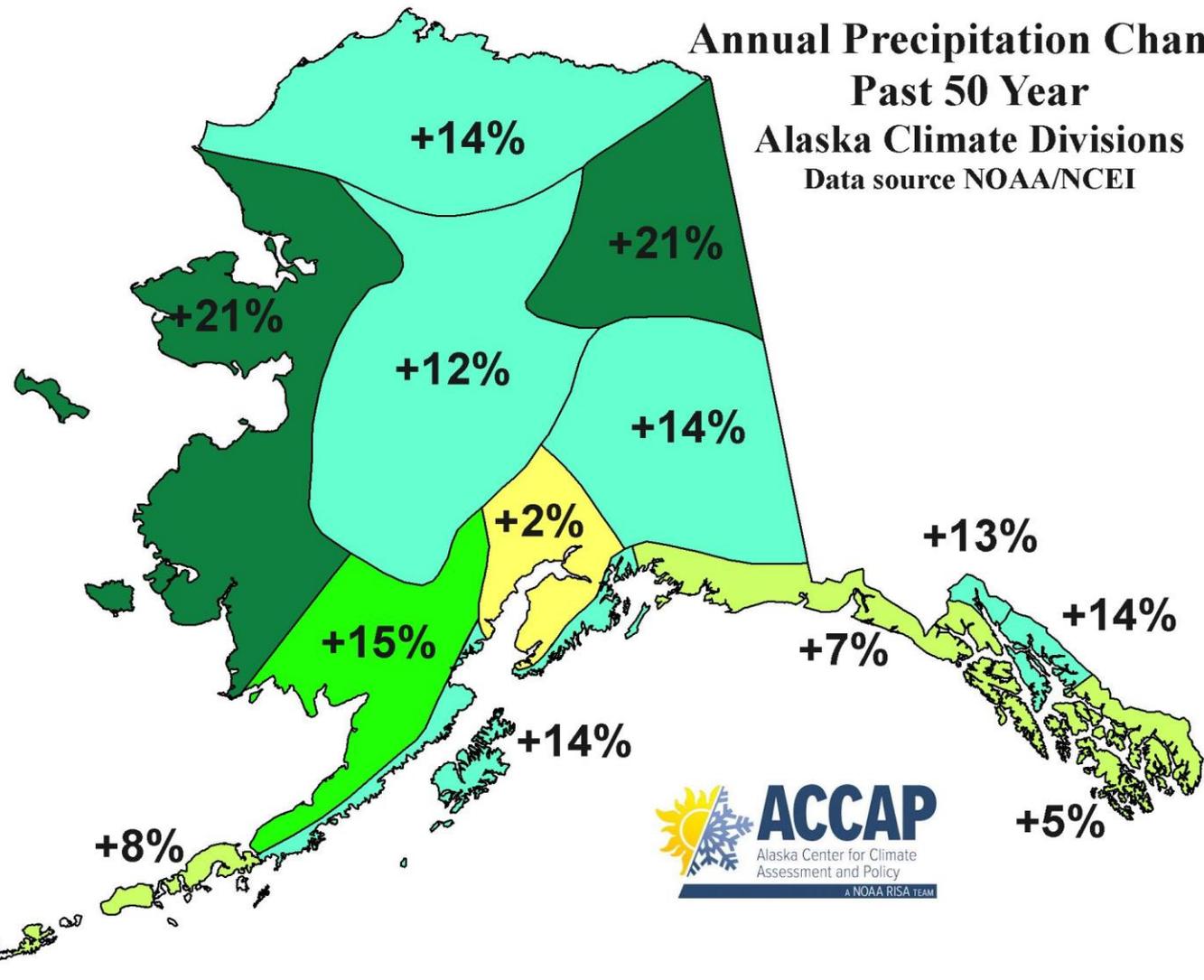
# Precipitation Changes

**1972-2021**  
**Total Change**



Change as percentage of 1972-2021 average

**Annual Precipitation Change**  
**Past 50 Year**  
**Alaska Climate Divisions**  
Data source NOAA/NCEI



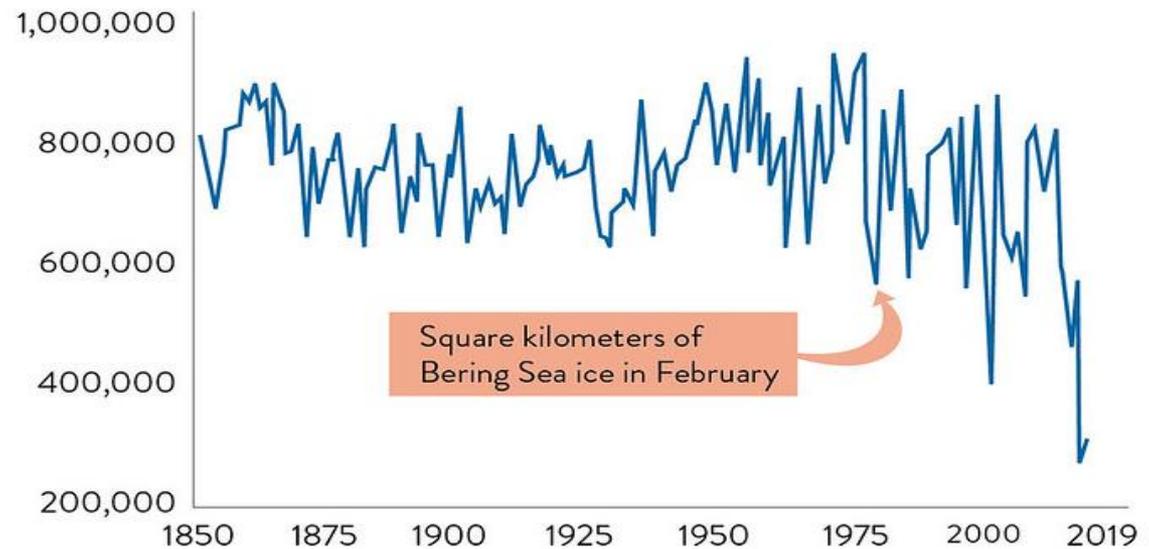
# Sea Ice & Water Temperature Changes

- Sea ice forming later
- More large open water areas
- Rapid decline in sea ice concentration



Credit: Marc Lester/AP

### Sea ice extent in the Bering Sea, 1850–2019



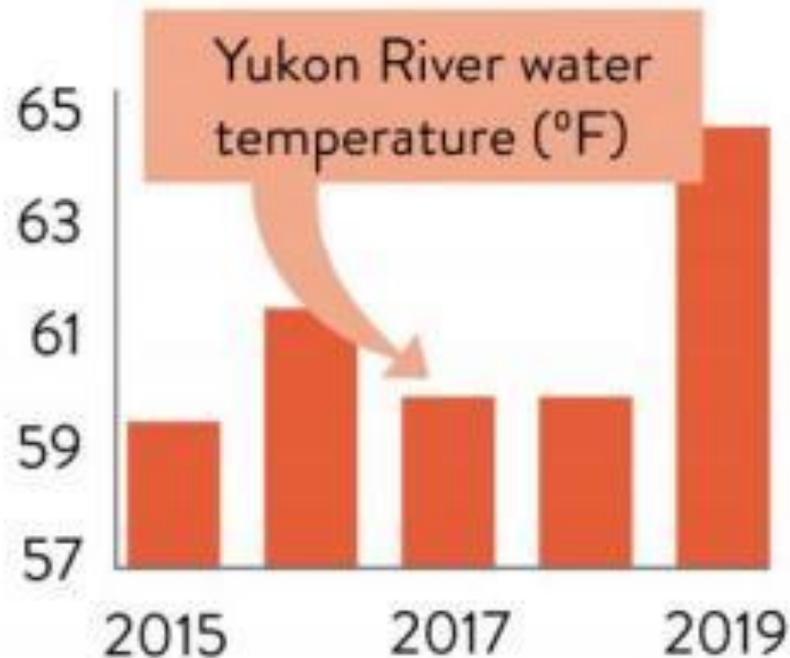
Credit: Zachary Labe, University of California, Irvine.

Data source: Scenarios Network for Alaska + Arctic Planning

# Warming Marine & Riverine Water Temperatures

- Ocean acidification
- Algal blooms
- Salmon die-offs

Water temperatures, Yukon River, 2015–2019

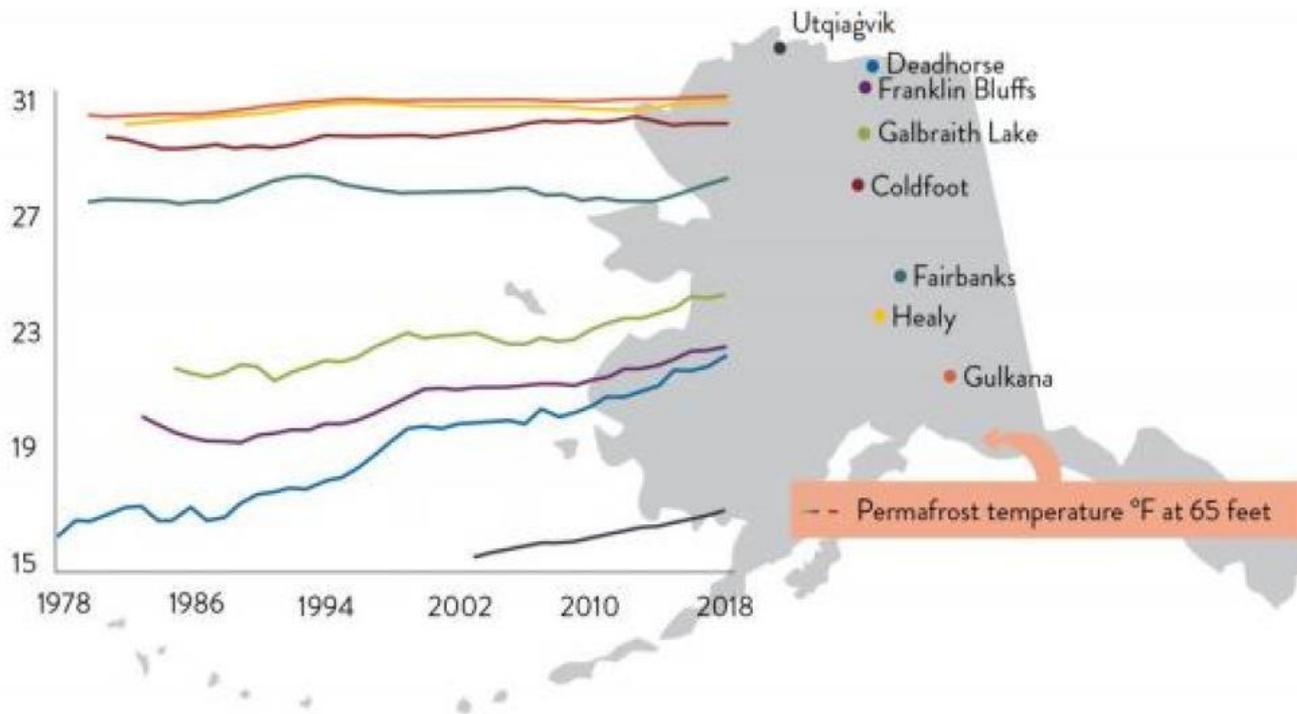


Credit: Rick Thoman, Alaska Center for Climate Assessment and Policy.

Data source: DOI/USGS

# Thawing Permafrost & Glacial Retreat

## Alaska permafrost temperatures, 1978–2018

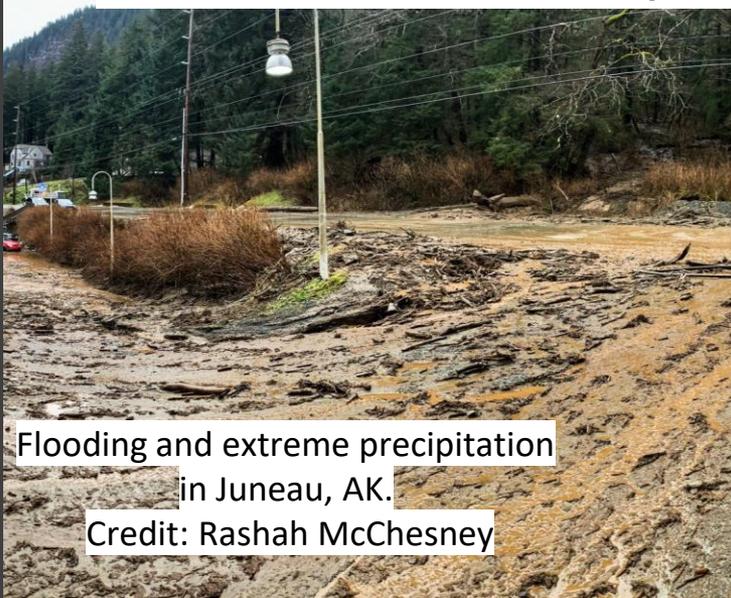


- Warming and thawing permafrost throughout AK.
- 90% of Alaska's glaciers are retreating.

Credit: Vladimir Romanovsky, Geophysical Institute.

Data source: GI Permafrost Lab Thermal State of Permafrost. Database, NSF

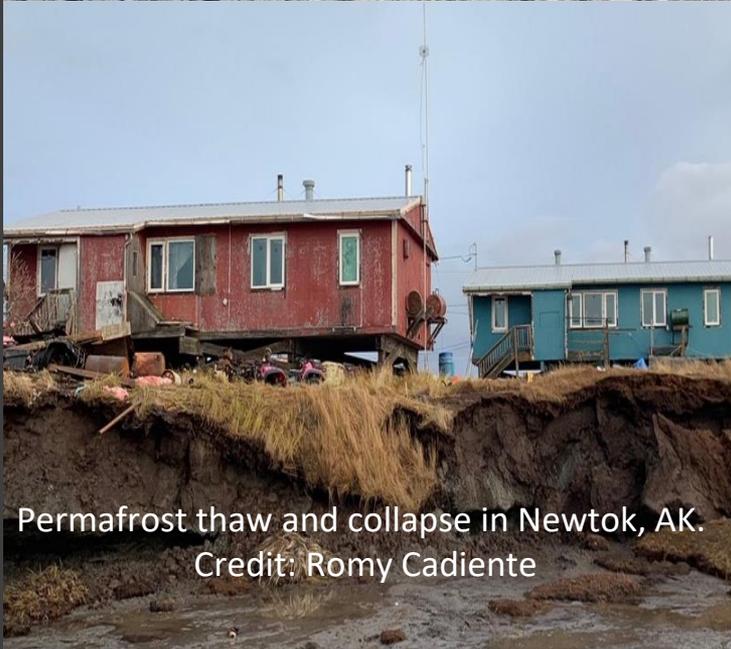
# Extreme Precipitation and Erosion Impacts



Flooding and extreme precipitation  
in Juneau, AK.  
Credit: Rashah McChesney



Hidden Creek Glacier, R.D. Karpilo 2004



Permafrost thaw and collapse in Newtok, AK.  
Credit: Romy Cadiente

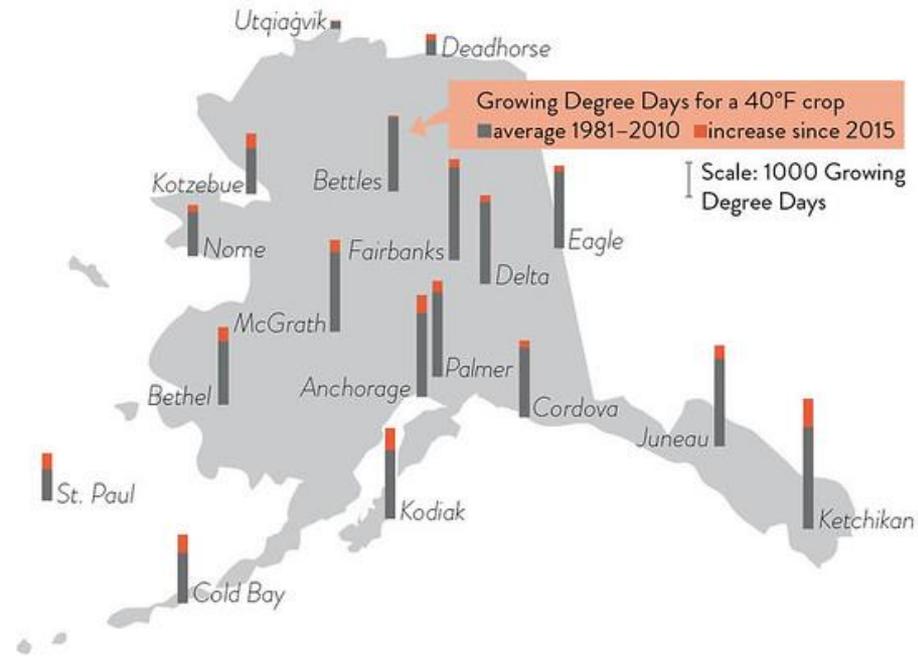


Glacial thinning and melting on Hidden Creek Glacier 1916 vs 2004.  
Credit: NPS

# Alaskan Plants in a Changing Climate

- Longer growing seasons throughout the state
- New crops grown
- “Greening” of the North Slope
- Invasive plants

## Alaska Growing Degree Day increases since 2015



Credit: Nancy Fresco, Scenarios Network for Alaska + Arctic Planning and Rick Thoman, Alaska Center for Climate Assessment and Policy.  
Data source: NOAA/NCEI, NDAWN, Canadian Journal of Plant Science, 2006

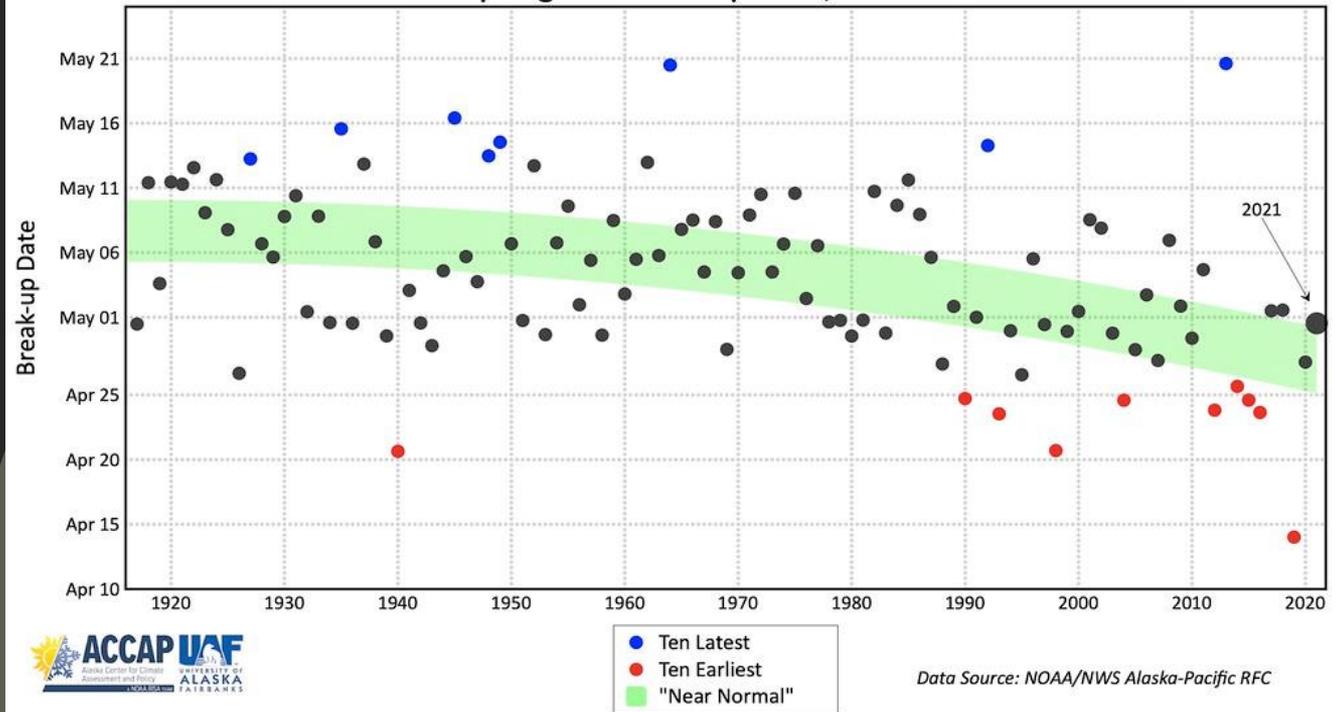
# Seasonal Variations

- Increase in smoky days
- Increase in acres burned per year
- River break-up happening earlier
- Snow falling later and melting earlier
- Sea ice accumulating later and melting earlier



Credit: SNAP

Tanana River at Nenana  
Spring Ice Break-up Date, 1917-2021



# Why does this matter for Alaskans?

## December 2021 Alaska Weather & Climate Highlights

